



CHRONOLOGICAL STUDY OF THE WATER RESOURCES MANAGEMENT WITHIN THE BANAT HISTORICAL REGION (1716-2016)

Andreea-Mihaela DUNCA

West University of Timișoara, Department of Geography

Email: andreea.dunca@e-uvv.ro

Abstract: *The Banat hydrographical space beneficiates of complex hydrotechnical planning, which is the result of a long process of water resource management that started 300 years ago with the plan of the zone's reorganization by the imperial administration. For the economic development of the historical region of Banat, the drying of the swamps but also the transport of wood and the agricultural goods it was mandatory since the year 1716 to manage the water resources. In the long history of these activities, several periods, with various characteristics, almost identical with the steps of water resources management at the Romanian level. The activity of water resources management of Banat's hydrographic space, took place until today with the help of a hydrotechnical organization plan that respects the guiding principle and the multilateral use of water resources. This plan assumes the completion of some constructions on the main waterways and the shaping more and more complex hydrotechnical fitting plans with an important role in the formation and influence over the processes of water flux. Nowadays, Banat's hydrotechnical fitting plan is complex and includes all hydrotechnical fitting techniques and many other types of hydrotechnical works such as: hydrotechnical work of maximum debit regulation and reduction of floods (damming works, permanent and impermanent storages) as well as certain river's engineering and shore embankment works of the most important running waters.*

Key words: *Banat historical region, hydrographical space, water resources management, hydrotechnical fitting plan, hydrotechnical plan, hydrotechnical works*

1. INTRODUCTION

The extreme hydrological phenomena such as floods are natural geographical phenomena, quite common in the Banat hydrographical area, which occur with a fairly high intensity and with a periodicity of about 30 years. However, there are cases when these occur only at intervals of a few years (Arba, 2010, Arba, 2013). For flood mitigation and for quantitative water management into a geographical area or into a hydrographical basin a hydrotechnical fitting plan is realized which proposes the

execution of some specific hydrotechnical works. The water management concept addresses the issue of water resource management as well as solid water flows and also the issue of meeting the water requirements both in terms of quantity and quality, through various actions, structural and non-structural works and measures (Stanciu et al., 2010, quoted by Dunca, Bădăluță-Minda, 2017). The most recent water regulation in waters domain from Romania, which represent the main work mechanism of the „Romanian Waters” National Administration is the Water Framework Directive (2000/60/EEC), which has become operational our country since its adherence to the European Community (UE) in January 2017.

The „Romanian Waters” National Administration applies the national strategy and policy in the field of quantitative and qualitative water management with several aims: knowledge, conservation, rational use and protection of water resources, prevention of destructive water effects, ecological reconstruction of watercourses, ensuring hydrological monitoring, implementation of legislation harmonized with EU Directives in the field of water management and conservation of aquatic ecosystems and wetlands. In the Banat region, the need to expand the agriculture in order to ensure decent living conditions has imposed from the beginning the execution of some special hydrotechnical works for preventing and eliminating the danger of floods and the excess humidity in the low areas. In Timișoara, the capital of the Romanian Banat and the largest city of this historical region there is a rather old tradition in the field of hydrotechnical works, for the reason that the city was initially situated on a low and marshy terrain, there was a steady and constant struggle in order to combat excess water. At the beginning of the fourteenth century the castle of King Carol Robert could not be built without the technical knowledge of construction works in marshlands, therefore in 1514 the peasant army of Gheorghe Doja attempted to deviate the Bega river course for drying the water from ditches of Timișoara fortress.

2. CHARACTERISTICS OF THE BANAT HISTORICAL REGION

The Banat hydrographical area overlaps Banat’s historical region and includes the geographical area around Timișoara, previously polarized by this regional center, bounded by the Danube, Tisza and Mureș, which are part of the Romanian territory (the Romania Banat located in the south-western part of the country), but also of the Serbian territory (Serbian Banat situated in the eastern part of the country) and Hungary (on a small area), (see Figure 1).

The name Banat dates back to the period of the Hungarian Crown domination, when all the border counties were called „banaturi”, which were led by a ban, such as: Banul de Severin, Banul de Belgrad, Banul de Sabăț. The name Banatus Temesvariensis or Banatus Temesiensis has appeared for the first time in Luigi Ferdinando Marsigli’s reports from the last decade of the 17th century, but also in the Karlovitz peace treaty (1699) (Ioniță, 1982). Historical Banat has an area of 28.526 km², and after the division of this province in 1919, Romania has about two thirds of the area (18.966 km²), the Kingdom of Serbs, Croats and Slovenes, about a third of the total (9.276 km²) and Hungary a small portion of about 1 % (284 km²) (Arba, 2015). From an administrative point of view, the Banat spreads in Romania on the territory of five counties: Timiș, Caraș-Severin (without the following localities: Bucova, Cornișoru, Bouțarii de Jos, Bouțarii de Sus and Preveciori), Arad (just south part of the Mureș river), Mehedinți

(only the west of this county with the following localities: Baia Nouă, Dubova, Eibenthal, Eşelnița, Orșova and Șvinița) and Hunedoara (only Sălciva and Pojoga localities) (Crețan, 1999).

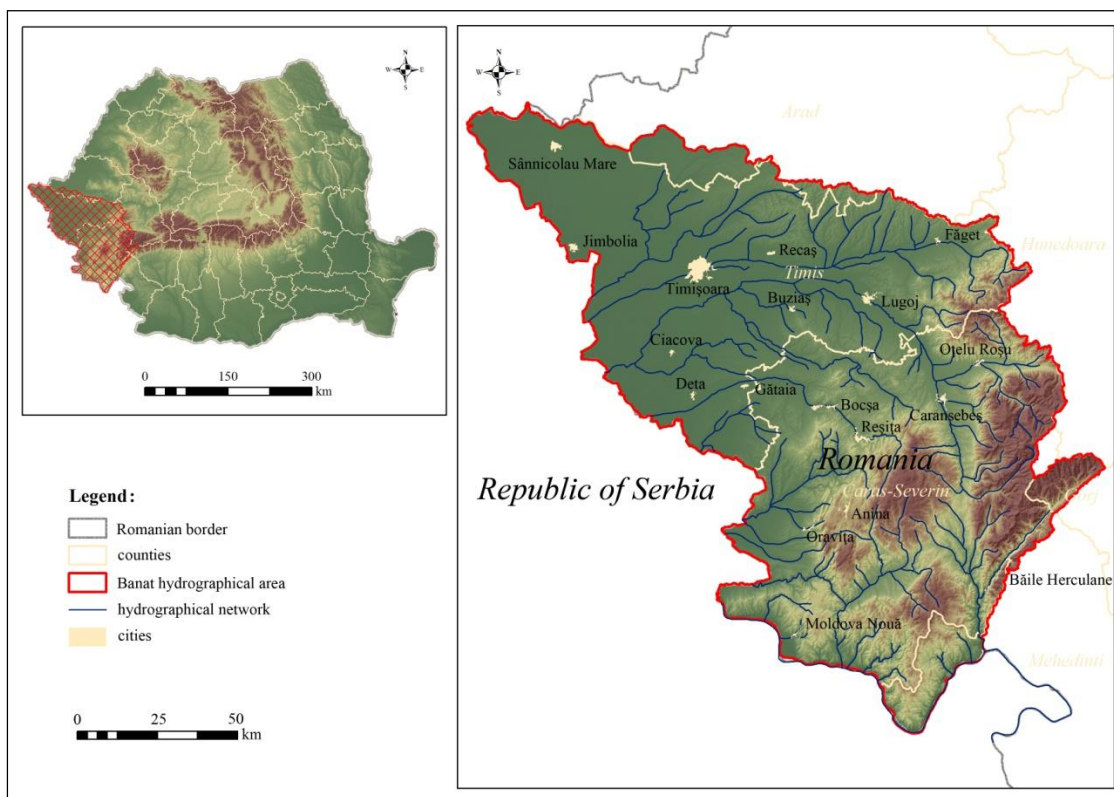


Figure 1. The Banat hydrographical area within Romania
(sursa: Dunca, Bădăluță-Minda, 2017)

In Serbia, the Banat spreads to the territory of the Voivodina (the eastern part of Tisza, consisting of the: Banatul de Nord, without the following communes: Ada, Senta and Kanjiza, Central Banat and South Banat) and of the Central Serbia (a small part of Banat, located to the west of Pancevo and the Timiș river, the largest part of the Palilula commune, attached to the Belgrade metropolitan area), and in Hungary it includes the south-eastern corner of the Csongrád county, located at south of Mureș and to the east of Tisa (Crețan, 1999).

With its quadrilateral form shaped by several important rivers (Danube, Mureș, Tisa and Cerna) and with a considerable area, the Banat was throughout the years, through its various areas, a province disputed by the Hungarian kingdom, the Bulgarian country, the pre-state formations and Romanian state (IX-XIV centuries), with the borders always exposed. This region constituted a unitary part of the Kingdom of Hungary (1315-1323), then from the 16th century, of the Ottoman Empire (1552-1716), after which at the end of the 18th century Banat became a „Country crown”, a province of the Austrian Empire (1716-1778), with a special status, under the direct coordination of the Viena Court. The special status of Banat was due to its territorial position, Banat being considered a strategic military, economic and political node, located on the border with the Ottoman Empire and at the intersection of commercial roads to the Balkans. After the year 1867, this land belonged to the Hungarian part of the Austro-Hungarian

Empire and after the First World War, it was divided on ethnic lines between the three national states whose ethnicities lived then in this area, namely: Yugoslavia, Romania and Hungary.

3. THE WATER RESOURCES MANAGEMENT IN BANAT

The management activity of water resources from Banat hydrographical area, started from the oldest times and continued to the present moment, is represented by: various laws and regulations in the water field, studies and projects drawn up during the construction of hydrotechnical works in the area, publications of some outstanding researchers, research projects, carried out in different institutions etc. In the history of this activity carried out over time in Banat, several periods can be identified with different characteristics, approximately similar with the stages of the water resource management activity in Romania (Arba, 2016).

3.1. The period of the first written documents regarding the use of water resources

The first written documents on Romania's water resources date back to the ancient times when the inhabitants began to use water for various practical purposes. In the beginning, Danube's waters were used for navigation by both the Geto-Dacians and the Greek, Roman and Byzantine merchants, who penetrated upstream the Danube and then the main rivers from our country, including Mureş, which is the northern boundary of Banat, and Bârzava, the tributary of Timiș, were used for the floating of the wood exploited in the area (Ujvári, 1972).

3.2. The period of the first hydrotechnical works

During the imperial administration (1716-1778) the Banat historic province was considered a quite populated region, whose social and economic rise was made possible by a reorganization plan of the area, started by the cavalry chief Claudius Florimund de Mercy, named the military governor of the Banatul Timișan, which included a large hydromeliorative action by carrying out works on regulation and innings the mars areas (Arba, 2016). Through the reorganization plan of Banat, in 1728 it appeared „The Building Regulations”, through which measures were taken regarding the reorganization of this province and several important works (1723-1765) were carried out on: the regulation of some watercourses, such as those in the Bega river bed, which made possible the expansion of Timișoara and the disappearance of the marshes, which caused many diseases, the reorganization of the main cities, especially of Timișoara (Olaru, 2006). Thus, for the economic development and the profitability of the region, for the mowing of the marshes that made the air unhealthy and the non-drinking water, but also for the transport of wood and agricultural products, 1716, the realization of a water resource management activity in this hydrographical area was imposed. Banat is the first region in Romania which benefits from a plan for water resource management and first achievements in this sense. The first hydrotechnical works carried out on the territory of our country were built in 1718, concerning the drying up of some swamp areas around Timișoara, then in the period 1726-1754, regarding the construction of the Bega

navigable canal and last but not least during the period 1728-1738, regarding the connection between the Timiș river and Bega river, with the purpose of draining the land between the two river beds (Munteanu, 1998).

Regarding the situation of land and floods at the beginning of the eighteenth century in the Banat Plain, historian Grisellini wrote a detailed description of the situation on the ground in the 5th letter from this paper on the history of Banat (1779): „*The Aranca Squash reached the Canija Mică to Mocrin. Besides, the waters of Bega, Timiș, Birda, Bârzava and a lot of brooks and springs, were left to their free will: no one knew how to use the means of hydrotechincs. Not dug through the dykes, the waters filled up all the lowlands and formed new and bigger muds than the old ones or sludge pits that were not accessible to humans or animals...*” (Feneșan, 1984). The economic development of Banat started by the Habsburgs after its takeover by the Turks is reflected in the accomplishment of the mentioned works, but also to others, such as the construction of the Dognecea Mare and the Dognecea Mică dams (1750-1758), somewhat similar to some Turkish dams near Istanbul, later known as „incze” dams, which led some authors to consider Banat as a gateway to this type of dams to Europe (Stanciu et. al., 2010). Starting with 1757, the works initiated by Claudius Florimund de Mercy are continued by the Dutch engineer Maximilian Emmanuel de Fremaut, who tried to solve water supply problems for Timișoara, to ensure the water discharge needed for Bega navigation and flood prevention.

With regard to the use of the Bega Canal for navigation, in 1754 when the work was completed, the commodity transport activity began on this channel, which has contributed to the economic development of the Banat region and of the DKMT Euroregion (Crețan, Turnock and Woudstra, 2008). In 1752 the Timișoara Port, was located in the Iosefin district of Timișoara, in 1756, the first regulation of navigation and trade on Bega was established, and in 1775 the „Navigation Office of Timișoara”.

3.3. The period of organizing systematic observations on the rivers from Banat

This period begins with the nineteenth century and is characterized by the beginning of large-scale drying up works in the western plains of the West Plain, where there were numerous marshes and frequent floods (Arba, 2016). The year 1807 is very important in the execution of hydrotechnical works in Romania, characterized by the emergence of Law 17, which more clearly regulated the execution of hydrotechnical works, that named a royal commissioner, who could act to remove obstacles in the river bed, where appropriate (Stanciu et. al., 2010). In the history of the water management works on the present territory of Romania, the year 1829 marked the transition from local defense works, which were not included in a general plan as a whole, to large-scale works based on numerous engineering studies. Thus, in the immediate period, the first plans for watercourse regulation of Tisa and its tributaries appeared, the flood defense action started in the previous period by the damming in the Banat rivers continued, the setting up of the gates of the Cazane-Portiile de Fier and the transformation of the natural course of the Danube into a navigable one, and works for the watercourse regulation of the Danube (1834-1837), at the exit of the gorge, for the improvement of the navigation. A series of laws were drafted in: 1836, 1839, 1840 (the most important law in the history of watercourses regularization in Romania - Law 10) and 1844, parallel to the preparation of various studies and projects (Stanciu et. al., 2010). These events have urged the establishment of the first hydrometrical stations on the current territory of

Romania, which are located in Banat and are situated on the Danube, the river that borders the region to the south (Orșova in 1838, Drencova in 1854 and Baziaș in 1874) (Ujvári, 1972).

During this period other hydrometric stations in Banat have been established, which have a specific historic value, as they are among the oldest hydrometric stations on the territory of Romania. These are: Radna (1853), Săvârșin (1859) and Arad (1861) on the Mureș river, Caransebeș (1870), Lugoj (1874), Șag (1874) and Teregova (1902) (1875), Făget (1875) and Balinț (1875) on the Bega river, Cenei (1888) on the Bega Veche river, Bocșa Montană (1880) and Partoș (1880) on the Bârzava river (Miță, 2010, Ujvári, 1972). The Technical Service of the Bega Canal established in 1841 the first damming in project in the Banat catchment area, whose aim was to dam in the right bank of Timiș, from Topolovăț to Șag, in order to improve the hydrological situation around Timișoara (Cozma et. al., 1974). The Treaty of Paris, ended after the Crimean War of 1856, led to the formation of the International Commission of the Danube, based in Vienna, which included England, France, Italy, Russia and the countries bordering the Danube. At the same time, the European Commission of the Danube was also established, which included England, France, Italy and Romania and which was based in Galați. The two commissions initiated a series of studies on liquid and solid discharge and frost phenomena on the Danube in order to improve navigation conditions (Lăzărescu et. al., 1972).

With the greatest flood ever since, occurred in July 1859, the issue of flood defenses was brought back into question, and the Bega Canal Technical Service drew up a new project that took into this flood account which also included some works started between 1860-1861 (Cozma et. al., 1974). The project stipulated that the Bega floods would be led to the Timiș river through the Topolovăț Discharge Channel, and from Topolovăț to Mодоș, the right bank of the Timiș river would be damped, leaving an opening at the mouth of the Timișoara Canal through which the waters of the basin located on the left bank of the Bega Navigable Canal to be discharged into the Timiș river (Cozma et. al., 1974). In addition to the above-mentioned works, the project also included other works, totaling 68 rectifications along the whole course of the Timiș river, which were designed to improve leakage water, especially on the Timiș river (Cozma et. al., 1974). As far as the navigation on the Bega Canal is concerned, it continued uninterruptedly and in 1869 the first passenger races on the Bega river, Timișoara, the most important city in Banat, became the first city on the current territory of Romania, using this way of public transport.

Because the works carried out under this project did not have the expected success in terms of protection against floods, Timiș-Bega Association was rebuilt in 1871, establishing as its main objective the regulation of the whole water system, sending in Timiș the large waters from Bega by redistributing the Bega-Timiș Discharge Channel (Topolovăț-Hitaș) (Olaru, 2006). The floods from May 1887 proved once again that the Bega and Timis rivers were not able to carry their own floods at that time, and that all the other rivers and canals that were within the Association area were in need of significant, in the execution of certain hydrotechnical works. Thus between 1887-1889, several flood defense projects were developed, applying the principle of flood storage (Cozma et. al., 1974).

According to the above-mentioned conditions, works have been planned on several rivers in Banat, among them: Bega Veche, Bega, Timisana, Surgani, Poganiș, Lanca Birda, Bârzava, Terzia, Moravița, Roiga, Vârșeț and Păuliș (Cozma et. al., 1974).

In order to reduce the excess of water in the Banat, hydrotechnical works were carried out, consisting of a series of channels, constructions and installations to collect, transport and discharge excess of surface water and ground water on the surface of this region (Dunca, Bădăluță-Minda, 2017). Along with the damming in the main watercourses, in the areas with excess surface water and ground water, numerous draining works were executed during the years 1881-1914, forming several drainage systems administered by associations of the interested communes and by Timiș- Bega: Timiș, Tolvadia, Răuți, Utvin, Rudna and Gad.

In 1892, under the direction of I. Péch engineer, "The Tisza Flood Announcement Service" and its main tributaries, and a little later, in order to coordinate the observation activity on the whole territory of Romania, 8 hydrographic services were established, one of which is located inside Banat, which is in fact one from Timișoara, established in 1896 and the other one was situated on the northern border of Banat, which is one from Arad, founded in 1892. In 1898, the first water law was issued, referring in particular to navigation, which stipulated that the main water courses, as well as the waters of the sea, to a distance from *a cannon from the shore* belong to the public domain (Stanciu et. al., 2010). Besides the execution of the mentioned hydrotechnical works, several plans for the hydrotechnical development of Banat were also included in various projects and plans, and also some permanent storages, which were made only after certain studies have been made. In 1915, the Banloc Draining Association was established in order to carry out works for the collection and discharge of waters from Banloc, Ofsenița, Ghilad and Partos communes, but due to lack of funds and because of the lack of interest of the associations, it did not execute any of the land remained under the influence of the waters until 1948-1949, when the draining of this area began (Cozma et. al., 1974). All of these systems, incomplete in the form in which they were executed, did not address the need to evacuate the water excess from atmospheric precipitations, which continued to damage the crops. After the union of Romania, the necessity of drafting a water law became more and more important, so that a committee of parliamentarians and specialists drafted a law bill which was published in the Official Gazette on August 4 1921. This law planned for a comprehensive water use program, but it was not applied until 1924, when it was rectified and republished under the name of the *Waters Regime Law* (Stanciu et. al., 2010).

3.4. The beginning of the study of the water flow on the rivers from Banat

This period is characterized by the consequences of the 1924 consolidation of capitalism in Romania, which resulted in an increasing interest in the leakage water regime on the mountain rivers in our country, which had a very high hydropower potential important in the construction of small hydropower plants on the Banat rivers, in that case the river Bârzava, tributary of Timiș (Arba, 2016). During this period, Romanian engineers were aware that observations on level variations were not sufficient to carry out all hydrotechnical works in the hydrotechnic fitting plan and that these observations should be completed by debit variations and some volumetric determinations. Because of that, in 1927, the General Directorate of Waters began discharges measurements (Ujvári, 1972). In 1924, the *Energy Law*, provided for the rational use of natural energy resources, by the completing arrangement of waterfalls, in order to save the exhaustible sources and the *Waters Regime Law*, the first water law in Romania, a continuation of the 1921 law, stipulated that waters with high hydropower

potential are public goods (Dunca, Bădăluță-Minda, 2017). Through Waters Regime Law, the Supreme Council of Waters was created, and in 1925 the Department of Waters appeared in the Ministry of Public Works, which was divided by sectors of activity based on hydrographic basins and to which belonged the Romanian Hydrographic Service (Stanciu et. al., 2010). Since its first year of existence, the Romanian Hydrographic Service has, except for the Danube, centralized the hydrometric concerns of Romania, and has prepared and published the first "Romanian hydrographical directories" (Miță, 2010). This period ended with the Second World War when the program of observations made at the hydrometric stations in the country began to record interruptions in Transylvania between 1940 and 1941 and in all the hydrometric stations in the country from 1944 (Ujvári, 1972).

3.5. The period of study and planned use of the Banat water resources

During this period, the bases of water resources planning are laid on Romania's territory based on their use in the production of hydroelectric power (Arba, 2016). In Banat, flood removals were regulated on a significant area through watercourse regulation and damming works performed until that time, but to ensure that the flood protection was complete, the attention had to be directed to the execution of the draining works. Thus, after 1944, a sustained action was carried out by setting up systems for the draining and capitalization of agricultural lands by executing, completing and rehabilitating several draining works (Cozma et. al., 1974). In 1945 the first proposals and studies of D. Leonida, C. Dinculescu and C. Mateescu appeared in the elaboration of the Electrification Plan of Romania, and in 1949 the Hydrographic Department at the Institute of Studies and Power Engineering (ISPE) of the "Ministry of Electricity", and a network of hydrometric stations for the mountain regions was to be realized in the near future (Stanciu et. al., 2010). The development of hydrology in Romania has been boosted in the period 1949-1951 due to this Institute. Because it has carried out a series of hydrological synthesis works, empirical formulas for the calculation of maximum and minimum flows, edited a series of hydrological directories and published a manual of Hydrology (Lăzărescu et. al., 1972).

A positive role in this period was also the establishment in 1949 of the "Danube Commission", which consisted of representatives of the Danubian countries and which was based in Budapest. This Commission has unified the issues of data navigation, including the methodology for observations, measuring and developing hydrological forecasts (Lăzărescu et. al., 1972). In 1950, a vast project was made for the full use of water in order to electrify the country, and the "Water Directorate" was transformed in 1951 into the "General Hydrometeorological Directorate" (DGH), which brought together three departments that collaborated in the elaboration of the plans for the complete arrangement of the main fluvial systems. On the basis of the data obtained from the program of observations and measurements from the hydrometric stations, synthesis works were made that could determine the hydrological characteristics required by the water management and the design of the hydrotechnical works and to carry out prognostic studies (Lăzărescu et. al., 1972).

The year 1950 begins with the first actions in the process of electrification of Romania, including the Decision no. 1177 of 27 October, which planned for: the provision of electric power for the building of the socialist bases (1951-1960), the multilateral use of water and the elaboration of a general plan for electrification and

water management on hydrographical basins (Stanciu et. al., 2010). Since 1950 many hydrotechnical works have been carried out which required many studies and aimed at consolidating the dams and their annexes to increase their safety against large waters (Cozma et. al., 1974). In 1953 the works for the Hydraulic Research Laboratory in Ciurel started, which later (1957) turned into the Institute of Hydrodynamic Studies and Research (ISCH) and the Institute for Hydrogeological Engineering Design (IPCH) was formed, which later changed its name to the Institute for Hydrotechnical Plans and Construction (IPACH) (Stanciu et. al., 2010). Since 1953, the "Hydrometeorological General Directorate" began to publish, under the leadership of engineer D. Lazarescu, daily hydrological bulletins containing the levels and forecasts on the rivers in Romania, necessary in informing all branches of the national economy (Lăzărescu et. al., 1972, citat de Dunca, Bădăluță-Minda, 2017). In 1956 began the inclusion of the state network and other departmental networks, a network was set up to observe the regime, hydrological balance of the lakes and the Black Sea, and starting in 1958, started a network of hydrogeological observations (Ujvári, 1972).

During the communist period, many pumping stations were built in the Banat region, old pumping stations were replenished, refurbished and electrified, and began the campaign for irrigation systems on large surfaces, for field and rice crops, land of state farms and agricultural production cooperatives (Wehry, Pañtu, 2008). In order to ensure the study and multilateral use of waters at country level, the "State Water Committee" was established in 1957. It functioned in addition to the "Council of Ministers" as a competent institution in the field of hydrology, hydrotechnics and improvement with tasks such as: observation activities, conducting studies and projects, giving opinions and partially executing hydrotechnical objectives. In 1959, Romania switched to water management on hydrographical basins, being among the first countries in the world to consider at that time that the hydrographical basin is the most suitable natural unit for water resource management. Thus, between 1959 and 1960, the first hydrotechnic fitting plans were made and the basics of the complex arrangement of the hydrographical basins was established, a concept that was later applied in the design of hydrotechnical works in Banat (Stanciu et. al., 2010). In 1969, the Institute for Hydrotechnical Plans and Construction (IPACH) was disbanded, its water supply and sewerage concerns, as well as hydrotechnic fitting plans were transferred to other institutions, and concerns about dams and watercourse regulation were incorporated into the new Institute for Studies and Design for Land Improvement (Stanciu et. al., 2010). Along with these changes, there was also a restructuring of the water activities, the dam design and reconstitution activities go from the Ministry of Agriculture to the National Water Council at the Institute for Studies and Research and Water Management (ISCPGA), from which the Institute of Hydrotechnical Research (ICH) detached in 1976 (Stanciu et. al., 2010).

Due to the fact that significant floods occurred in Banat (1970, 1972, 1974, 1975, 1978, 2000 and 2005) this proved the incapacity of this area to cope with these phenomenon (Arba, 2010). The activity of water resources management intensified in the last years, by finalizing the hydrometric network and by constructing the last hydrotechnical works, being the most prolific stage after the Second World War (Dunca, Bădăluță-Minda, 2017). The hydrotechnic fitting plans, which have since become scheme-planning frame and waters management, have been periodically reviewed and underpinned all hydrotechnical developments that have taken place over the last 40-50 years across Banat. The appearance of the Environmental Protection Law (Law No. 137/1995) and the Water Law (Law No. 107/1996), which have been modified in the

meantime, introducing the concept of the river basin management and management scheme (Ujvári, 1972), Romania's entry into the European Union (2007), as well as the assimilation of its water legislation, revealed some irregularities in the water resource management policy, which should be solved. At this stage, the foundations of hydrology are laid as a modern science in our country, and modern methods of research, that have facilitated the rational use of water resources in the Romanian geographic space, have been introduced. The activity of water resources management in the Banat hydrographical area, carried out constantly over 3 centuries (1716-2016) by means of a sustained development plan, which respects the principle of mastering and multilateral use of water, implied the execution of some fitting works on the main watercourses and the shaping of an increasingly complex hydrotechnical scheme, with a very important role in the formation and influence of leakage water processes.

4. CONCLUSIONS

The Banat catchment area benefits from a complex hydrotechnical improvement, as a result of a long-term water resource management that begins 300 years ago (1716) with the reorganization plan of the area initiated by the Imperial Administration. Banat is the first region of Romania that benefits from a systematic and sustained plan in terms of water resources management activity and first achievements in the hydrotechnical field. The first hydrotechnical works carried out on the territory of the Romanian Banat are those undertaken in 1718 by the imperial administration concerning the rehabilitation of some marshy areas around Timișoara, then in the period 1726-1754, regarding the construction of the Bega Navigable Canal and last but not least the period 1728-1738, concerning the realization of connection channels between the river Timiș and the Bega River, with the purpose of draining the lands between the two river beds.

The hydrotechnical fitting scheme of the Banat hydrographical area is a complex one and comprises all hydrotechnical techniques and several types of hydrotechnical works such as: hydrotechnical works for the regulation of maximum flows and mitigation of flood waves (damming works, permanent storages and impermanent storages), with the purpose of defending against floods and reducing the negative effects that these extreme hydrological phenomena might cause and regulation works of some river beds and damming of the most important watercourse banks within the most important cities and several rural localities. In order to achieve efficiency in integrated water resources management of this hydrographical space, it is necessary: to adopt an appropriate approach in the analysis of policies and options in order to contribute to right decisions making according to the specific conditions of the analyzed area, the application of the technical measures, economical, legislative, organizational and social, undertaken by the Romanian Waters Administration and periodical updating of water and water management framework schemes.

REFERENCES

- Arba, A., M. (2016), *Resursele de apă din sistemul hidrografic Timiș-Bega: geneză, regim hidrologic și riscuri hidrice*, West University of Timișoara Press, Timișoara, 544 p.
- Arba, A., M. (2015), *Posibilități de valorificare a resurselor naturale și etnografice din Banat pentru dezvoltarea turismului rural, agroturismului și ecoturismului*, ms., West University of Timișoara, Timișoara, 150 p.

- Arba, A., M.**, (2013), *Extreme hydro-meteorological phenomena on the hydrographical basin of Timiș river (1965-2009)*”, Riscuri și catastrofe, editor: Victor Sorocovschi, Casa Cărții de Știință Press, Cluj-Napoca, no. XII, vol. 12, no. 1/2013, pp. 99-112.
- Arba, A., M.**, (2010), *History of floods occurred in Banat*, Review of Historical Geography and Toponomastics (RHGT), vol., no. 9-10, West University of Timișoara Press, Timișoara, pp. 45-52.
- Cozma, M., Oprea, V., Văcaru, P.**, (1974), *Pământuri renăscute, sisteme de desecări în Județul Timiș*, edited by Direcția Generală a Agriculturii, Industriei Alimentare și a Apelor din Județul Timiș, 84 p.
- Crețan, R.**, (1999), *Etnie, confesiune și comportament electoral în Banat. Studiu geografic*, West University of Timișoara Press, Timișoara, 358 p.
- Crețan, R., Turnock, D., Woudstra, J.**, (2008), *Identity and multiculturalism in the Romanian Banat*, Méditerranée 110 (1), pp. 17-26.
- Dunca, A., M., Bădăluță-Minda, C.**, (2017), *The Complex Hydrotechnic Structure in Banat Hydrographical Area*, vol. “Air and water – components of the environment Conference”, editors: Gavril Pandi and Florin Moldovan, Presa Universitară Clujeană Press, Cluj Napoca, pp. 151-158.
- Dunca, A., M., Bădăluță-Minda, C.**, (2017), *The water resource monitoring through the network of hydrometric stations from the Banat region (Romania)*, 17th International Multidisciplinary Scientific GeoConference SGEM 2017, SGEM2017 Conference Proceedings, Albena, Bulgaria, 29 June - 5 July, 2017, Vol. 17, Issue 31, pp. 745-752.
- Feneșan, C.**, (1984), *Încercare de istorie politică și naturală a Banatului Timișoarei*, Facla Press, Timișoara, 336 p.
- Ioniță, V.**, (1982), *Nume de locuri din Banat*, Facla Press, Timișoara.
- Lăzărescu, D. et al.**, (1972), *Istoricul preocupărilor de prognozare a viiturilor din România*, Studii de Hidrologie. Prognoza scurgerii în timpul viiturilor din ploi pe teritoriul României, vol. XXXIII, Institute of Meteorology and Hydrology, Bucharest, pp. 12-25.
- Miță, P.**, (2010), *Din istoria hidrologiei românești*, Romanian Association of Hydrological Sciences, Bucharest, 72 p.
- Munteanu, R., M.**, (1998), *Bazinul hidrografic al râului Timiș - studiu hidrologic*, Mirton Press, Timișoara, 210 p.
- Olaru, Martin**, (2006), *Three Centuries of Hydrotechnical Constructions in Banat (I)*, Review of Historical Geography and Toponomastics (RHGT), volumul I, numărul 1, Universitatea de Vest din Timișoara, 87-102.
- Stanciu, P., Tecuci, I., Bretotean, M., Oprișan, Elisabeta, Călin, Maria, Radu, E., Rădescu, M., Macaleț, Rodica**, (2010), *Scurtă incursiune în istoria hidrologiei, hidrografiei, hidrogeologiei și gospodăririi apelor*, “Apele Române” National Administration and the National Institute of Hydrology and Water Management, Bucharest, București.
- Ujvári, I.**, (1972), *Geografia apelor României*, Științifică Press, Bucharest, pp. 339-365;
- Wehry, A., Panțu, H.**, (2008), *Amenajări hidroameliorative*, vol. I, Aprilia Print Press, Timișoara, 210 p.
- Wehry, A., Panțu, H.**, (2008), *Amenajări hidroameliorative*, vol. II, Aprilia Print Press, Timișoara, 390 p.
- ***, Directive 2000/60/EEC of the European Parliament and of the Council - Water Framework Directive, establishing a framework for community action in the field of water policy, 2000;
-